X-ray generation enhancement from a nano-structured targets irradiated by long laser pulses

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1. INTRODUCTION

It is well known that the energy transformation efficiency from femtosecond laser pulses to XUV emission may be enhanced by using nanostructured targets. Nanostructured surface and low density porous layers are often used to increase laser absorption and to control plasma density. Here, EUV emission spectra from targets with tin covered closely packed polystyrene microsphere monolayer on a foil, silicon wafer is deposited with tin and from porous alumina targets covered by a thin tin layer irradiated by 7 ns and 170 ps Nd:YAG lasers were recorded with a flat field grazing incidence spectrometer equipped with a variable groove spaced grating. We have investigated the variations of the emission spectra with the laser irradiance. The conversion efficiency into 13.5 nm spectral region was deduced. The emitted X-rays can be suitable for various applications such as a lithography and biological imaging.

2. EXPERIMENTAL SETUP

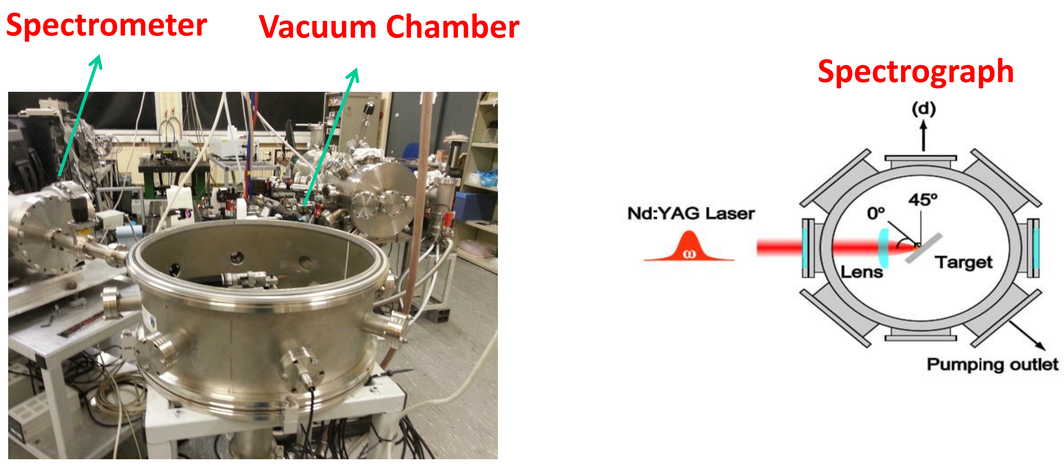

Figure 1: Experimental setup& Schematic of the experiment. Pulses from an Ekspla SL312P 170ps and Surelite 7ns Nd:YAG laser were focused on Microstructure targets.

3. TARGETS

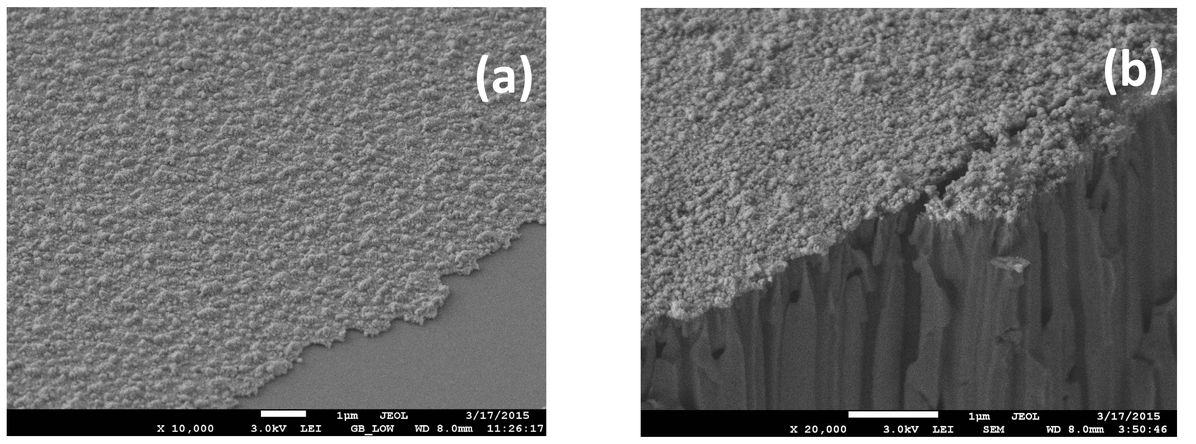

Figure 2: SEM image of Nano-structured targets **(a)** silicon Wafer is deposited with Tin **(b)** porous alumina targets covered by a thin tin layer **(c)**with tin covered closely packed polystyrene microsphere monolayer on a foil

4. RESULTS

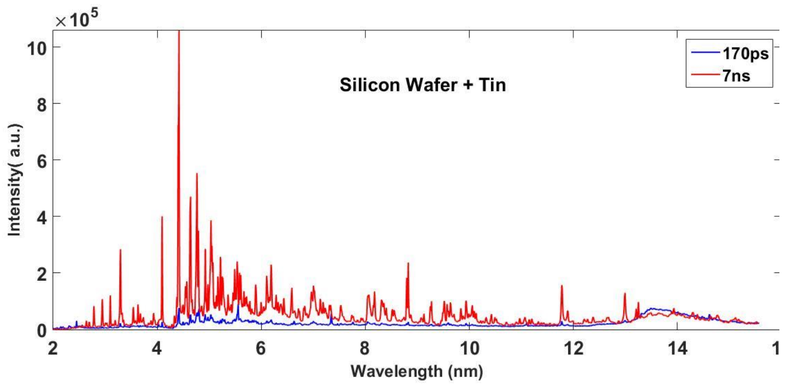

Figure 3: Emission Spectra of Silicon Wafer + Tin under 170ps and 7ns

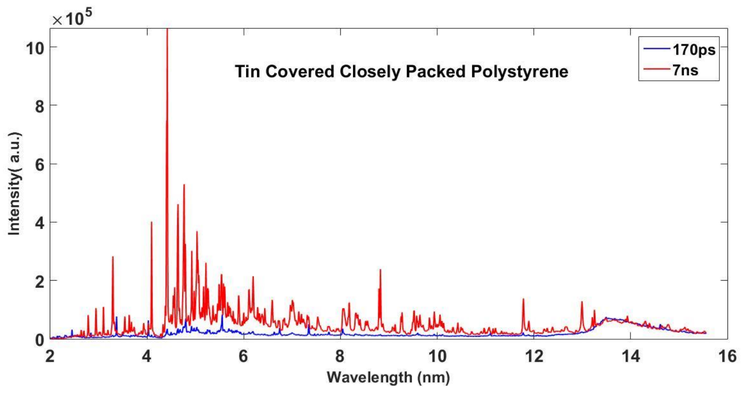

Figure 4: Emission Spectra of Tin covered Closely packed polystyrene under 170ps and 7ns

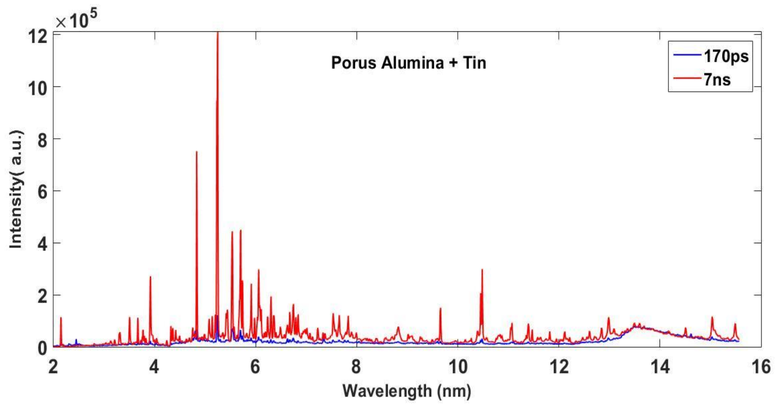

Figure 5: Emission Spectra of Porous Alumina+ Tin under 170ps and 7ns

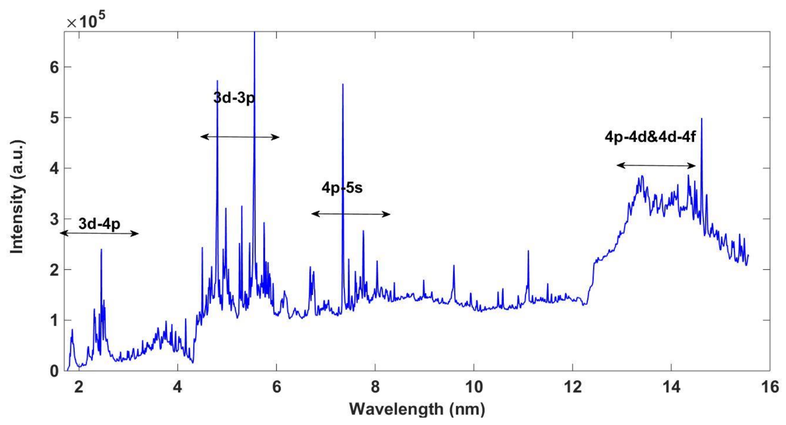

Figure 6: Pure Tin Spectra with ions

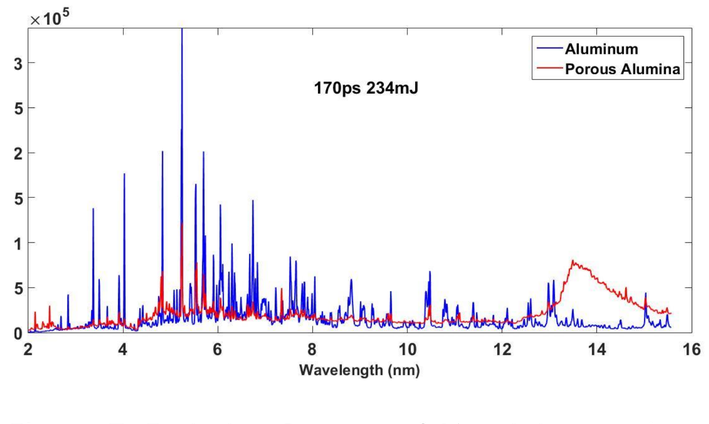

Figure 7: Emission Spectra of Aluminium and Porous Alumina under 170ps

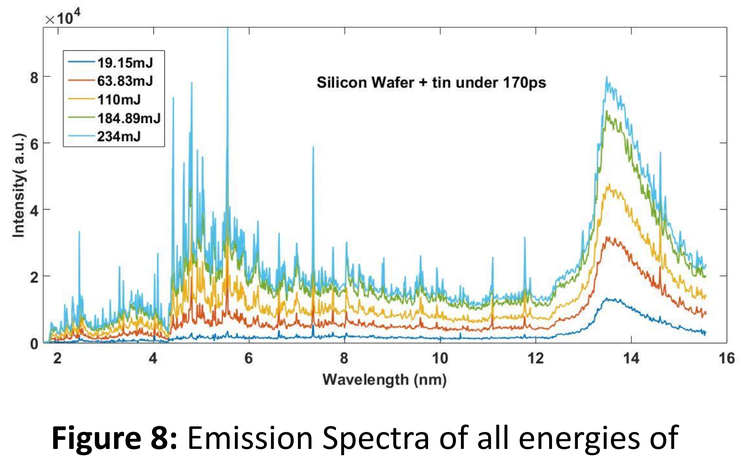

Figure 8: Emission Spectra of all energies of Silicon Wafer + Tin under 170ps

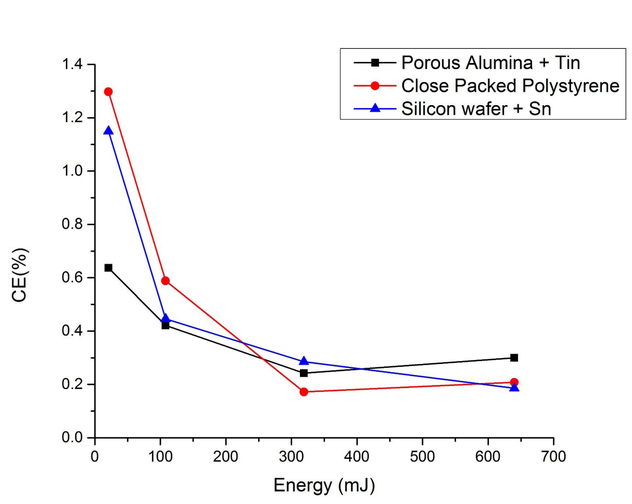

Figure 9: Conversion Efficiency of the different structured targets under 7ns

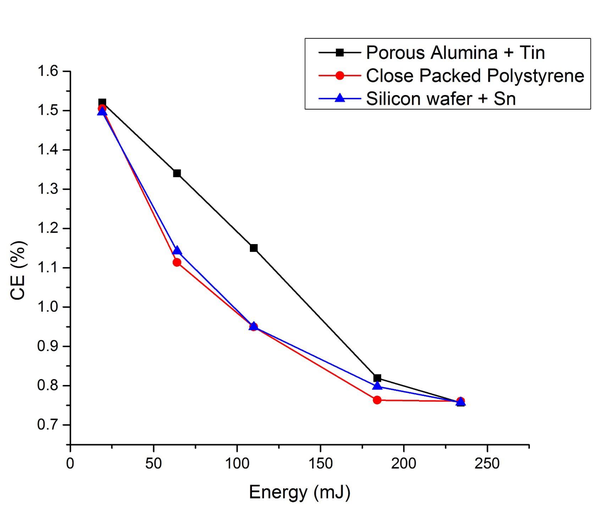

Figure 10: Conversion Efficiency of the different structured targets under 170ps

5. CONCLUSIONS

- We observed higher conversion efficiency and emission under picosecond laser for all structured targets compared to nanosecond laser
- Porous Alumina plus tin target has higher conversion efficiency than others specifically for 170 ps laser

6. FUTURE WORK

- To try existing targets and other targets under femtosecond laser

Acknowledgements: Work supported by the Education, Audiovisual and Culture Executive Agency (EACEA) Erasmus Mundus Joint Doctorate Programme Project No. 2012 – 0033.

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